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EVIDENCE OF ENGEL CURVES IN FOOD AWAY FROM HOME: A STUDY OF MALAYSIA

by

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ABSTRACT

As Malaysians' per capita income continues to grow, the food budget shares declines, which refers to Engel's law. However, the statistics of the various Household Expenditure Surveys in Malaysia reported increasing food away from home (FAFH) budget shares which concerns whether the notion of Engel's law can be extended to FAFH. By using Household Expenditure Survey 2004/05, the Heckman two-step procedure was applied with the Working-leser and other functional forms to conduct the Engel curves analyses. The empirical results exhibit the same observations as laid down in the Engel's law. All the estimated expenditure elasticities of demand for FAFH were less than unity. Thus, this study verified that the notion of Engel's law can be extended to FAFH in Malaysia.

Keywords: *Engel's law, food away from home, expenditure elasticity.*

JEL code: Q11

1.0 INTRODUCTION

Original Engel curves explain that the change of expenditure for different goods as a function of income and household size. Engel (1857) found that food expenditures are an increasing function of income and of family size, but food budget shares decrease with income. To be more specific, the shares of income spent on food are inversely related to income level, where poorer households devote higher shares of income to food than richer households, even if actual expenditures on food rise. Such theory is rested on the magnitude of the expenditure elasticity. In other words, expenditure elasticity of demand for food must be less than one. The proportion of income spent on food is positively related to household size, where households of bigger family size devote a higher share of income to food than households of small family size.

Complying "Engel's curve", Household Expenditure Survey (HES) 1973, 1980/82, 1993/94, 1998/99, and 2004/05 observed that total food budget share of

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Malaysian household expenditure typically falls as income and expenditures increase. From 1973 to 2004/2005, share of total expenditure on food in response to income, comprising both food at home (FAH) and food away from home (FAFH) decreased from 38.3% in 1973 to 31.2% in 2004/2005. On average, expenditure on FAH declined steadily from a share of 33.7% in 1973 to 22.20% and 20.4% in 1998/99 and 2004/05 respectively. Meanwhile, expenditure on FAFH rose from only 4.6% in 1973 to 10.80% in 2004/05. These statistics pose the same question whether Engel's law is applicable in the case of FAFH. This is because the confirmation of Engel's law for total food expenditures does not necessarily applicable in the FAFH. The objective of this study is to examine the applicability of Engel's law on FAFH in Malaysia.

2.0 PREVIOUS STUDIES

Classical approaches to estimating cross-sectional Engel curves are based on parametric models. Working (1943) proposed the log-linear budget share specification, which is known as the Working-Leser model, since Leser (1963) found that this functional form fit better than some alternatives. Previous studies by Hausman et al. (1991), Hausman et al. (1995), Lewbel (1991), Bryne et al. (1996), Blundell et al. (1998), and Blundell et al. (1993) find quadratic terms are needed in the model.

Basic Engel functions are represented by the relationship between consumption and income. However, the consumption patterns of households also respond to demographic and socio-economic variables. By including demographic and socio-economic variables to enter parametrically would result in semi-parametric specification. In the context of Engel curve estimation non-parametric smoothing methods have been applied in a few studies, for example, in Bierens and Pott-Butler (1990), Bryne et al. (1996), Banks et al. (1997), and Blundell et al. (1998). The plausible point of semi-parametric estimation is that of the framework to arrive to a more economic theory consistent specification. For example, it is reasonable to expect bigger household size to spend more on food than smaller household size.

Expenditure elasticities in previous studies have demonstrated that Engel's law is applicable in FAFH by showing that FAFH is a necessity in America (Byrne et al., 1996; Yen, 1993; McCracken and Brandt, 1987; Holcomb et al., 1995). While most Malaysian literatures on food demand have focused on consumption at home (Tee and Thiam, 1975; Hussein et al., 1986; Baharumshah, 1993; Baharumshah and Mohamed, 1993; Nik Mustapha, 1994; Nik Mustapha et al., 2001), the estimated expenditure elasticities of demand for FAFH in Radam et al. (2004) are positive and less than one. Thus, it is expected that the notion of Engel's law can be extended to FAFH in Malaysia.

3.0 DATA

The Household Expenditure Survey 2004/2005 was conducted by the Department of Statistics is consumer expenditure surveys in Malaysia. The survey consisted of a random sample of 14,084 households throughout Malaysia. The large number of households in the survey provides higher degrees of freedom in econometric estimation than using time-series data.

The main objective of the Household Expenditure Survey is to collect current information on the levels and patterns of consumption expenditure by households on a comprehensive range of goods and services. Findings from this survey were used to determine the goods and services to be included in the basket of the Consumer Price Index (CPI). They are also used to update the CPI weights where the CPI is a measure of the average rate of change in prices of goods and services, which represent the expenditure pattern of all households in Malaysia.

Data on expenditure was collected by the method of direct interview by the field officers of the Department of Statistics. The duration of the survey was twelve-month beginning in July 2004 and ending in June 2005. Different samples were canvassed for every month. Spreading the survey over twelve months ensured that seasonal variations in expenditure on account of various festivals during the year and also commencement of school terms were taken into consideration.

One of the major econometric problems in modeling demand using cross-sectional household expenditure data is that many households did not purchase various foods during the survey period. Thus, only econometric models that can handle the zero consumption are occupied in this study.

4.0 ESTIMATION TECHNIQUES

Based on Engel's law, income and household size have a positive relationship with food expenditure. To remain consistent with this theory, the framework used in the Engel curves analyses of FAFH can be expressed as:

$$EXP_h = f_h(Y_h, hhsize_h, Z_h) \quad (1)$$

where EXP_h is expenditure in ringgit for FAFH by the h^{th} household, Y_h denotes monthly income of household h, $hhsize_h$ represents household size of household h, and Z_h refers to other socio-demographic characteristics. Higher income households are hypothesized to spend more on FAFH than lower income households. Similarly, households of bigger family size are hypothesized to spend more on FAFH than households of small family size.

Followed Bryne et al. (1996), in order to handle the zero consumption and the sample bias problem in expenditure on FAFH, this study applied Heckman's two-step estimation (Heckit) procedure suggested by Heckman (1978), as this procedure is less restrictive than the Tobit estimation technique (Haines et al., 1988). In the first stage, a probit regression is computed in order to estimate the probability that a given household purchases FAFH in question. This regression is used to estimate the inverse Mills ratio for each household, which is used as an instrument in the second regression. In the second stage, the initial Working-Leser model and other functional forms with the inverse Mills ratio are estimated.

In the first stage, the decision for the household is modeled as a dichotomous choice problem:

$$I_h = \beta_1 \log(Y_h) + \beta_2 \log(hhsize_h) + \beta_3 \log(age_h) + \beta_4 urban_h + \beta_5 employed_h + \beta_6 penin_h + \beta_{7i} swak_h + \beta_8 male_h + \beta_9 malay_h + \beta_{10} cina_h + \beta_{11} indian_h + \varepsilon_h \quad (2)$$

From Equation (2), the inverse Mills ratio, IMR_h, for every household can be computed as:

$$IMR_h = \frac{\phi_h(x,g)}{\Phi_h(x,g)} \quad (3)$$

where x and g are the vector of expenditures and the vector of demographic variables for the household, respectively. ϕ_h is the density probability function, and Φ_h is the cumulative probability function.

In the second step, the following Working-Leser model and other demand functional forms incorporating the computed inverse Mills ratio, IMR_h, as an instrument variable is estimated:

Working-Leser:

$$s_h = a_1 + a_2 \log(Y_h) + a_3 \log(hhsize_h) + a_4 \log(age_h) + a_5 urban_h + a_6 employed_h + a_7 penin_h + a_8 swak_h + a_9 male_h + a_{10} malay_h + a_{11} cina_h + a_{12} indian_h \{+\alpha IMR_h\} + \varepsilon_h \quad (4)$$

From equation (4), the expenditure elasticity can be estimated as below:

$$e_y^h = 1 + \frac{a_2}{s_h} \quad (5)$$

Semi-Logarithmic:

$$EXP_h = b_1 + b_2 \log(Y_h) + b_3 \log(hhsize_h) + b_4 \log(age_h) + b_5 urban_h + b_6 employed_h + b_7 penin_h + b_8 swak_h + b_9 male_h + b_{10} malay_h + b_{11} cina_h + b_{12} indian_h \{+\mu IMR_h\} + \varepsilon_h \quad (6)$$

From equation (6), the expenditure elasticity can be estimated as below:

$$\ell_y^h = b_2 + \frac{1}{EXP_h} \quad (7)$$

Double-Logarithmic:

$$\log(EXP_h) = c_1 + c_2 \log(Y_h) + c_3 \log(hhsize_h) + c_4 \log(age_h) + c_5 urban_h + c_6 employed_h + c_7 penin_h + c_8 swak_h + c_9 male_h + c_{10} malay_h + c_{11} cina_h + c_{12} indian_h \{+\gamma IMR_h\} + \varepsilon_h \quad (8)$$

From equation (8), the expenditure elasticity can be estimated as below:

$$\theta_y^h = c_2 \quad (9)$$

Quadratic:

$$\log(EXP_h) = d_1 + d_2 \log(Y_h) + d_3(\log(Y_h))^2 + d_4 \log(hhsize_h) + d_5(\log(hhsize_h))^2 + d_6 \log(age_h) + d_7 urban_h + d_8 employed_h + d_9 penin_h + d_{10} swak_h + d_{11} male_h + d_{12} malay_h + d_{13} cina_h + d_{14} indian_h \{+\delta IMR_h\} + \varepsilon_h \quad (10)$$

Expenditure elasticity can be computed upon the estimation of equation (10). According to Blundell et al. (1993), the expenditure elasticity can be estimated as below:

$$\eta_y^h = d_2 + 2d_3 \log(Y_h) \quad (11)$$

where:

I_h is one if a household purchased FAFH (i.e., $w_h > 0$), and zero otherwise.

s_h is expenditure share for the h^{th} household; thus, share could be for Total Food (TotFood), FAFH, or FAH.

EXP_h is expenditure in ringgit for FAFH by the h^{th} household.

$\log(EXP_h)$ is logarithm of expenditure for the FAFH by the h^{th} household.

$\log(Y_h)$ is logarithm of monthly income of household h.

$\log(hhsize_h)$ is logarithm of household size of household h.

$\log(age_h)$ is logarithm of age of household head of household h.

urban represents that household h resides in urban area (0, 1).
Base = rural area

employed represents that the household head of household h is employed (0, 1).
Base = unemployed

penin represents that household h resides in Peninsular Malaysia (0, 1).
Base = Sabah

swak represents that household h resides in Sarawak (0, 1).
Base = Sabah

male represents that the household head of household h is a male (0, 1).
Base = female

malay represents that the household head of household h is a malay (0, 1).
Base = other race/ethnic

cina represents that the household head of household h is a chinese (0, 1).
Base = other race/ethnic

indian represents that the household head of household h is an indian (0, 1).
Base = other race/ethnic

h surveyed household; h = 1,..., 14,084

5.0 RESULTS

Monthly budget shares for FAFH were developed by dividing FAFH expenditures by monthly income. The descriptive statistics in table 1 suggests that on average, households devoted approximately 11% of their household income to FAFH.

Table 1. Descriptive statistics.

Variable	Sample size	Minimum	Maximum	Mean	Standard Deviation
Monthly Food Expenditures (RM)					
Total food	14084	10.30	3934.00	166.61	122.64
Food at home	14084	10.30	2362.45	101.82	72.50
Foodservice	14084	0.00	3322.90	64.78	88.60
Monthly Food Budget Shares					
Total food	14084	0.02	1.00	0.36	0.13
Food at home	14084	0.02	0.91	0.25	0.13
Foodservice	14084	0.00	0.99	0.11	0.10

Scatter plot of the data in Figure 1 illustrates a possible Engel relationship between household monthly income and budget shares of FAFH. It clearly shows the inverse relationship between household monthly income and budget share, where households with higher monthly income devoted smaller budget share for FAFH. With such observation, there is big possibility that Engel law's can be applied on FAFH.

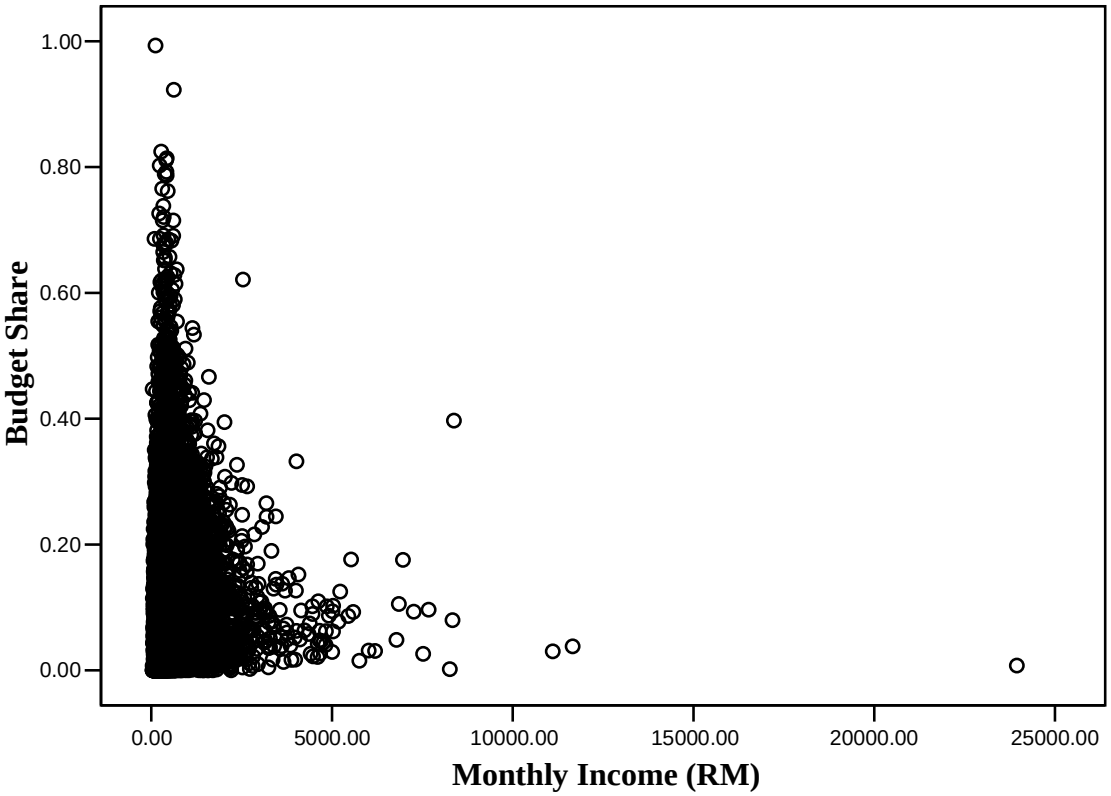

Figure 1. Scatter plot of monthly income and FAFH budget share.

Table 2 reports the parameter estimates of Engel's curve for Working-Leser and other functional forms. Working-Leser relates FAFH budget shares to the logarithm of income. Therefore, the Working-Leser regression allows a direct test of Engel's law. The Working-Leser regression reported negative and statistically significant coefficient for the logarithm of monthly income. It shows that FAFH budget shares decrease with increasing income. The semi- and double-logarithmic and quadratic forms reported

positive and statistically significant coefficients for the logarithm of monthly income. Such result shows that higher income households spent more on FAFH than lower income households. Similarly, Working-Leser and all three of these functional forms reported positive and statistically significant coefficients for the logarithm of household size. This means households of bigger family size spent more on FAFH than households of small family size. The quadratic form also reported negative and statistically significant coefficients for the squares of monthly income and household size. Households resided in urban area and household head who were employed are identified as positively and statistically significant related to expenditures on FAFH in Working-Leser and all three of these functional forms. The reasoning behind positive relationship between household head's employment and expenditures on FAFH is explained by McCracken and Brandt (1987), Yen (1993), and Byrne et al. (1996) that it is mainly due to time constraints for the household's production function. The signs and significance of the estimated coefficients associated of the other socio-economic characteristics varied by expenditure group and functional form.

Table 2. Parameter estimates of Engel's curve.

	Functional form			
Endogenous Variables	**Working-Leser Coefficient (t-statistics)**	**Semi-Logarithmic Coefficient (t-statistics)**	**Double-Logarithmic Coefficient (t-statistics)**	**Quadratic Coefficient (t-statistics)**
LOG(TOTEXP)	-0.011	53.869	0.92	3.163
	(-7.912)***	(53.319)***	(55.298)***	(22.198)***
$(LOG(TOTEXP))^2$	-	-	-	-0.183
	-	-	-	(-15.968)***
LOG(AGE)	-0.057	-33.819	-0.445	-0.432
	(-20.437)***	(-16.104)***	(-15.128)***	(-14.871)***
LOG(HHSIZE)	0.046	33.939	0.33	0.799
	(-29.789)***	(-29.185)***	(-19.165)***	(-18.078)***
$(LOG(HHSIZE))^2$	-	-	-	-0.235
	-	-	-	(12.503)***
URBAN	0.023	9.393	0.195	0.207
	(12.787)***	(7.073)***	(10.288)***	(11.008)***
EMPLOYED	-0.001	6.884	0.063	0.077
	(-0.247)	(4.216)***	(2.772)***	(3.444)***
PENINSUL	0.046	19.846	0.344	0.407
	(15.681)***	(8.972)***	(10.038)***	(11.964)***
SARAWAK	0.037	11.124	0.267	0.222
	(11.750)***	(4.631)***	(7.724)***	(6.480)***
MALE	0.002	7.821	0.022	0.048
	-1.092	(4.657)***	-0.953	(2.067)**

MALAY	-0.002	-9.923	-0.031	0.001
	(-0.544)	(-4.655)***	(-0.991)	-0.047
CINA	0.025	9.602	0.25	0.267
	(8.265)***	(4.178)***	(7.610)***	(8.234)***
INDIAN	-0.003	-12.876	-0.081	-0.068
	(-0.696)	(-4.056)***	(-1.831)*	(-1.553)
IMR	0.112	32.717	-1.015	0.498
	(23.542)***	(9.120)***	(-4.401)***	(2.016)***
Intercept	0.394	-116.334	-0.398	-7.833
	(28.063)***	(-10.993)***	(-2.370)**	(-15.851)***
R-squared	0.1818	0.424	0.4849	0.4975

Note: Significance levels are denoted by *** for 1%, ** for 5%, and * for 10%.

Expenditure elasticities of demand for FAFH are reported in Table 3. Expenditure elasticities of demand for FAFH ranged from 0.8315 (semi-logarithmic) to 0.9579 (quadratic). All these expenditure elasticities are less than one, complying Engel's law in Working-leser and every functional form.

Table 3. Expenditure elasticities of demand for FAFH at the means of the data.

	Expenditure Elasticity
Working-Leser functional form	0.9075
Semi-Logarithmic functional form	0.8315
Double-Logarithmic functional form	0.9197
Quadratic functional form	0.9579

6.0 CONCLUSIONS

As Malaysians' per capita income continues to grow, the food budget shares declines, which refers to Engel's law. However, the statistics of the various Household Expenditure Surveys in Malaysia reported increasing FAFH budget shares which concerns whether the notion of Engel's law can be extended to FAFH. By using HES 2004/05, the Heckman two-step procedure was applied with the Working-leser, semi-logarithmic, double-logarithmic and the quadratic forms to conduct the Engel curves analyses. The empirical parameter estimates exhibit the same observations as laid down in the Engel's law, where both income and household size are positively related to expenditures on FAFH. The Working-leser regression verified Engel's law directly by reporting negative and statistically coefficients for the logarithm of monthly income. Conforming to Engel's law, all the estimated expenditure elasticities of demand for FAFH were less than unity. Thus, this study verified that the notion of Engel's law can be extended to FAFH in Malaysia.

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